GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION
SPONSORED PROJECT INITIATION

OR
NO action

Date: FEBRUARY 23, 1977

Project Title: STUDENT SCIENCE TRAINING FOR HIGH ABILITY SECONDARY SCHOOL STUDENTS

Project No: E-27-543

Project Director: DR. JOHN L. LUNDBERG

Sponsor: NATIONAL SCIENCE FOUNDATION

Agreement Period: From 2/15/77 Until 10/31/77 (GRANT PERIOD)

Type Agreement: GRANT NO. SMI77-00708

Amount: $22,280

Reports Required: FINAL REPORT; SUMMARY OF COMPLETED PROJECT

Sponsor Contact Person (s):

Technical Matters	Contractual Matters (thru OCA)
	JAMES L. BOSTICK GRANTS OFFICER NATIONAL SCIENCE FOUNDATION WASHINGTON, D.C. 20550

Defense Priority Rating: NONE

Assigned to: TEXTILE ENGINEERING (School/Laboratory)

COPIES TO:

- Project Director
- Division Chief (EES)
- School/Laboratory Director
- Dean/Director—EES
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- Project Code (GTRI)
- Other

CA-3 (3/76)

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION

no action

Date: 4/12/78

Project Title: Student Science Training for High Ability Secondary School Students

Project No: E-27-543

Project Director: Dr. J.L. Lundberg

Sponsor: National Science Foundation

Effective Termination Date: 10/31/77

Clearance of Accounting Charges: 10/31/77

Grant/Contract Closeout Actions Remaining: None

_ Final Invoice and Closing Documents
_ Final Fiscal Report
_ Final Report of Inventions
_ Govt. Property Inventory & Related Certificate
_ Classified Material Certificate
_ Other _____

Assigned to: TE (School/Laboratory)

COPIES TO:

Project Director
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Director, Physical Plant
EES Information Office
Project File (OCA)
Project Code (GTRI)
Other _____

CA—4 (3/76)

NATIONAL SCIENCE FOUNDATION
Washington, D.C. 20550

SUMMARY OF COMPLETED PROJECT

Form Approved
OMB No. 99R0013

Please read instructions on reverse carefully before completing this form.

1. INSTITUTION AND ADDRESS	2. NSF PROGRAM	3. PRINCIPAL INVESTIGATOR(S)
Georgia Institute of Technology Atlanta, Georgia 30332	SMI/SST	John L. Lundberg

4. AWARD NUMBER	5. DURATION (MOS)	6. AWARD PERIOD	7. AWARDEE ACCOUNT NUMBER
SMI 77-00 708	8 1/2	from 2/15/77 to 10/31/77	E-27-543

8. PROJECT TITLE
Student Science Training for High Ability Secondary School Students - 1977 NSF-SST Program in Polymer, Fiber & Textile Science at the Georgia Institute of Technology, June 19-August 5, 1977.

9. SUMMARY (ATTACH LIST OF PUBLICATIONS TO FORM)

Forty four students from 37 high schools in 11 states participated in a seven week program of research and seminars in science and engineering. They worked on 42 different research projects with 34 research advisers from 13 schools and the Engineering Experiment Station of Georgia Tech. Most studies were multidisciplinary. Disciplines, major subjects and materials involved were engineering (20 projects), chemistry (14), physics (6), the environment (6), nucleonics (4), computing (4), life sciences (3), energy (2), fibers (2), polymers (3), and textiles (10 projects). Good results in the form of data, designs, demonstrations, materials, or structures were produced in at least half of the projects; results will be published in some of these as parts of research now in progress.

Participants attended 48 seminars in which science, engineering, and mathematics were discussed and demonstrated without the usual separation into disciplines. Our macromolecular environment was emphasized with discussions of polymers, fibers, and textiles. Eight speakers from other schools at Georgia Tech or from off campus presented seven colloquia. Four optional senimars on continuum mechanics and seven optional seminars on Newtonian mechanics, thermodynamics, and quantum mechanics were offered. All students were introduced to computing with three hours demonstration and hands-on experience. Four two-hour and two one-hour seminars on computing and use of the Georgia Tech computer facilities were optional. All participants took part in additional seminars on English, counselling, lab safety, and reports on their research. Three field trips, to an observatory and planetarium, to a nylon and polyester fiber plant and a nuclear and hydroelectric energy complex, and to botannical gardens and an experimental farm, demonstrated several applied sciences and engineerings at work. Fifteen group activities, including twelve off-campus outings and eight picnics or suppers were provided.

The students, 27 boys and 17 girls, 11 minority members, and 18 from schools with limited opportunity or encouragement in science, did well in their work, the best of any group in five Georgia Tech SST programs to date. They benefitted from study of science, mathematics and engineering without separation into subjects or disciplines. Students were required to work on their own; most responded well. Most made good transitions from the limited choices of rigidly structured secondary schools to the diversity of multi-disciplinary opportunities in a technical university.

9. SIGNATURE OF PRINCIPAL INVESTIGATOR/ PROJECT DIRECTOR	TYPED OR PRINTED NAME	DATE
	John L. Lundberg	12-15-77

NSF Form 98A (10-77) SUPERSEDES ALL PREVIOUS EDITIONS

INSTRUCTIONS FOR SUMMARY OF COMPLETED PROJECT
(NSF Form 98A)

GENERAL

Awardees are reminded that the requirement for the submission of this Summary to the National Science Foundation does not change the present requirement for reprints of publications to be forwarded to the Foundation program unit having cognizance over the grant. In addition to the Summary of Completed Project (NSF Form 98A), for reports to be deposited in the National Technical Information Service, Bibliographic Data Sheet (NTIS Form 35) should be used.

SUMMARY

The summary (approximately 300 words) must be self-contained so as to be intelligible to a knowledgeable reader. Without restating the project title, it should begin with a topic sentence stating the project's major thesis. In preparing the summary the author should include, if pertinent to the project being described, the following items:

—The primary objectives and scope of the project.

—The techniques or approaches used only to the degree necessary for comprehension.

—The findings and implications stated as concisely and informatively as possible.

Awardees should bear in mind that this Summary of Completed Projects may be used together with the project summary prepared by the Foundation at the time of the award to answer inquiries by nonscientists as to the nature and significance of the research which the Foundation supports. Scientific jargon and abbreviations should be avoided when possible.

The requirements outlined in the American National Standard for Writing Abstracts (ANSI Z39.14-1971) may be useful in preparing the summary.

PUBLICATIONS

A list of publications based all or in part on the information/findings generated by this NSF-supported project should be attached to this form when it is submitted to NSF.

SUBMIT TWO COPIES OF THIS REPORT TO:

NATIONAL SCIENCE FOUNDATION
DIVISION OF GRANTS AND CONTRACTS
POST-AWARD PROJECTS BRANCH
WASHINGTON, D.C. 20550

FINAL REPORT

1977 National Science Foundation Student Training Program in Polymer, Fiber & Textile Science & Engineering at the Georgia Institute of Technology

June 19 - August 5, 1977

- Abstract -

Forty-four students from 37 high schools in 11 states worked on 42 different research projects with 34 research advisers from 13 schools and the Engineering Experiment Station of Georgia Tech. Most studies were multidisciplinary Disciplines, major subjects and materials involved were engineering (20 projects), chemistry (14), physics (6), the environment (6), nucleonics (4), computing (4), life sciences (3), energy (2), fibers (2), polymers (3), and textiles (10 projects). Good results in the form of data, designs, demonstrations, materials, or structures were produced in at least half of the projects; results will be published in some of these as parts of research now in progress.

Participants attended 48 seminars in which science, engineering, and mathematics were discussed and demonstrated without the usual separation into disciplines. Our macromolecular environment was emphasized with discussions of polymers, fibers, and textiles. Eight speakers from other schools at Georgia Tech or from off campus presented seven colloquia. Four optional seminars on continuum mechanics and seven optional seminars on Newtonian mechanics, thermodynamics, and quantum mechanics were offered. All students were introduced to computing with three hours demonstration and hands-on experience. Four two-hour and two one-hour seminars on computing and use of the Georgia Tech computer facilities were optional. All participants took part in additional seminars on English, counselling, lab safety, and reports on their research. Three field trips, to an observatory and planetarium, to a nylon and polyester fiber plant and a nuclear and hydroelectric energy complex, and to botannical gardens and an experimental farm, demonstrated several applied sciences and engineerings at work. Fifteen group activities, including twelve off-campus outings and eight picnics or suppers were provided.

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Submitted by:

John L. Lundberg
NSF-SSTP Director
School of Textile Engineering
Georgia Institute of Technology

TABLE OF CONTENTS

Final Report: 1977 NSF-SSTP, Georgia Tech, June 19 - August 5

I. Preparation

A. Advertising

Mr. Craig Anderson of the School of Textile Engineering prepared a brochure (Appendix I) for distribution before awards of grants were announced. These were distributed to all principals, counselors, and science and math teachers in public schools and many private and parochial schools in Georgia. Distributions were made by direct mail to the schools, through science coordinators in the larger systems and to teachers at their homes through listings by the Georgia Education Association and the Science Teachers Association. In spite of double coverage to most teachers and schools and triple coverage in the larger school districts for five years many teachers remain unaware of our program. In principle all of these schools and teachers received the listing of all SST programs distributed by the Foundation.

Mr. Dallas Stewart, Science Coordinator, Education Department of the State of Georgia, and Mr. Lonnie Love, Assistant Coordinator, have been most helpful in 1973-77 in aiding us in contacting teachers, counselors, principals and school administrators. Thanks to their efforts we have been in contact with and participated in science programs of the regional resource centers in Georgia and in the Governor's Honors Program for high school students.

We advertised our program at science fairs, group meetings of students and/or teachers, and in our visits to high schools and talks for high school science classes. Mr. Craig Anderson, recruiter and adviser for incoming students for Georgia Tech's School of Textile Engineering publicized our program in his visits to high schools in Georgia. Members of the faculty of the School of Textile Engineering have participated in regional and the state science fairs in recent years; at these our program has been announced.

Our best advertising is by students who have been in the program and by teachers whose students have participated in our program. In the last three years teachers in the Atlanta public schools have encouraged their students to participate. Mrs. Lucy Smith, Science Coordinator for the Atlanta School system, and her predecessor, Miss Kathryn Hertzka, have helped our faculty to become acquainted with teachers and students in Atlanta, this by including faculty members in science programs and the Atlanta Science Congress. In 1976, this Atlanta science fair met in the School of Textile Engineering Building; the hosts were Georgia Tech and the campus chapter of Sigma Xi. The Atlanta Science Congress will be at Georgia Tech again in Februrary, 1977. This is good advertising for our summer program.

B. Selecting Students

Two hundred plus students inquired about our SST program. Eighty seven (87) students submitted complete applications. We accepted sixty one (61) of these as participants or alternates whom we would welcome into the program.

In 1977 as in previous years, students selected themselves for our program. Only those who are seriously interested bother with the application forms and short essay. Most of the students who apply have sufficient desire and drive to succeed in our SST program. The same is true of applicants for admission to Georgia Tech. Only seriously interested, committed students come here; easier schools are accessible for those who just want to go to college. This reputation of Georgia Tech "rubs off" on our SST program.

Each year we realize how little we know about selecting participants. We try to select on the following bases (in descending order of importance); 1. personal interviews with applicants, 2. telephone conversations with applicants, 3. statements in 300 words or less why the applicants wish to participate

in the program, 4. face to face and telephone conversations with teachers, 5. teachers written recommendations, 6. class rank, 7. grades in high school courses, and 8. scores on standardized examinations.

Mr. Craig Anderson, counselor for incoming students in the School of Textile Engineering, and the program director interviewed about one third of the applicants and talked to the others by telephone. We accepted a few students who should not have been accepted on the basis of test scores. For these students we found some correlation among the quality of students' written statements, teachers' recommendations, class rank, grades in courses, and scores on standardized examinations. Because of our interviews of all applicants from Atlanta in 1975 and many applicants for our 1976 and 1977 programs and careful consideration of grade, class rank and PSAT scores and our experience with students from less than advantaged schools, we could estimate which of the low score students could participate successfully in our SST program.

Seventeen (17) students whom we accepted as participants and who did not participate in our SST program spent this part of the summer as follows:

Three students attended other SST programs (Notre Dame, Rennsselaer, and an unnamed institution in New York).

Three students probably attended other SST programs.

Three students participated in other summer programs (Phillips Exeter Academy, Governor's Honors Program in North Carolina, and a church camp program in North Georgia).

Three students said they had to work.

One student served as Governor of the 4H Clubs of Tennessee.

One student felt he had to stay home to try to help prevent break-up of the family.

One young lady was married and set up housekeeping.

One student preferred to travel.

One student started the program but dropped out in the first week because he found employment and preferred spending money to participating in our program.

C. Soliciting Funds

We asked textile, fiber, carpet, and chemical manufacturers for financial help with the program. $4,784 was contributed by eight corporations. Our record on NSF grants, private support and numbers of contributors to date is as follows:

Year	NSF Grant	Private Gifts	Number of Participants
1973	$15,776	$1,750	31
1974	$11,430	$7,200	38
1975	$21,170	$1,500	37
1976	$20,660	$4,700	58
1977	$22,280	$4,784	44*

*(Forty-five students started the program; one dropped out.)

II. Participants

A. Profile

We compare our SSTP participants to our undergraduate students at Georgia Tech. About eighty-five percent of these are engineering, science and architecture majors with the majority in engineering. The average SAT score is about 1200. Compared to these undergraduates, we rate as good (with

grade 2.0 or C) those SSTP applicants whom we would welcome as undergraduates. With this frame of reference, our estimates of the participants and other applicants before the start of the program is given in Table II.

Table I

Estimated Potential for Research Performance of Participants and Other Applicants to Georgia Tech's 1976 SST Program

	Gifted (4.0=A)	Very Good (3.0=B)	Good (2.0=C)	Fair (1.0=D)	Poor (0.0=F)	Totals Number	Avg.Gr.
Participants	4	16	17	6	1	44	2.36
Limited Opportunity	0	7	6	4	1	18	2.06
Accepted applicants who did not participate	3	5	7	2	0	17	2.53
Limited opportunity	1	0	6	2	0	9	2.00
Alternates	0	1*	10	7	8	26	1.15
Limited opportunity	0	0	9	7	8	24	1.04

* British subject attending school in Japan.

At least eighteen (18) of the forty-four (44) participants have had limited opportunity to study and work in science. Further description of the group is given by the following data:

Number of girls	17
Number of boys	27
Number of members of "minority groups"	12
Number of inner city	8
Number from smaller cities	22
Number from suburbs	7
Number from small towns and rural areas	7
Number from Georgia	27
Number from other states	17
Number with good to superior over-all opportunity	26
Number whose opportunity could be improved	18
Number who lived on campus	35
Number of commuters	9

We had a good mixture of students with a wide variety of interests, backgrounds, preparation and developed ability. This diversity is necessary for and conducive to learning. The participants learned at least as much from

each other and Tech students as they did from faculty and staff. By interacting with peers a number discovered and developed latent interests and abilities.

B. Participants' Names, Addresses, High Schools and Research Projects and Research Advisers

Bret C. Baughn
705 Randolph Avenue
Huntsville, Ala. 35801

"A Study of the Magnetic Effects in Rare Earth Alloys" - B.R. Livesay (E.E.S.)

HUNTSVILLE HIGH SCHOOL - SENIOR

John David Bell
6500 Standingboy Rd.
Columbus, GA 31904

"A Video System Controller for Holographic Information Retrieval" - T.K. Gaylord (E.E.)

JORDAN VOCATIONAL SCHOOL - SENIOR

Denise M. Bly
P. O. Box 497
Grambling, LA 71245

"Wear Tests of Fabrics of Wool-Polyester Blends for U.S. Air Force Uniforms" D.R. Gentry (T.E.)

ALMA J. BROWN LABORATORY HIGH SCHOOL - SENIOR

David T. Brown, III
1445 Irwinton Road
Milledgeville, GA 31061

"A Study of the Gamma Ray Spectra of Bismuth - 207" - R.W. Fink (Chem.)

BALDWIN COUNTY H.S. - JUNIOR

Jeffrey G. Cantlebary
4418 Framons Court
Dunwoody, GA 30038

"A Study of Hydrogen as an Alternate Fuel for Internal Combustion Engines - and Magnesium Hydride as a Hydrogen carrier in a Supply System" - W.D. Freeston (T.E.)

DUNWOODY HIGH SCHOOL - JUNIOR

Michael D. Chapman
1417 Dale Drive
Savannah, GA 31406

"Identification of Trace Elements in Tobacco by Neutron Activation Analysis" - C.R. Allen and M.V. Davis (N.E.)

SAVANNAH CHRISTIAN HIGH SCHOOL - JUNIOR

Harry D. Colley
2204 Richmond Avenue
Augustua, GA 30904

"Syntheses of Complex Ions and Neutral Complexes of Cobalt, Nickel and Molybdenum" - H.G. Neumann (Chem.)

ST. THOMAS AQUINAS HIGH SCHOOL - SENIOR

Robert Dean Cox, Jr.
203 Auburn Drive
Dalton, GA 30720

"Studies of the Physical Properties of Rubbers Cured for Various Times and the Devulcanization of Rubber" - W.C. Carter (T.E.)

DALTON HIGH SCHOOL - SENIOR

John Jefferson DeGange
2221 Azalea Drive
Valdosta, GA 31601

VALDOSTA HIGH SCHOOL - SENIOR

"Studies of Film Densitometry and Film Diffusers for Use in Laser Optics" - J.M. Florence and W.T. Rhodes (E.E.)

Kenny A. Eddings
2208 Deborah Drive
Valdosta, GA 31601

VALDOSTA HIGH SCHOOL - SENIOR

"Construction of a Memory System for a Microprocessor" - J.E. Weaver (E.E.)

William T. Ellerbee, III
Route 3, Hendricks Road
Thomaston, GA 30286

ROBERT E. LEE INSTITUTE - SENIOR

"Studies of Soil Compaction and Moisture Content" - R.D. Barksdale (C.E.)

Marcelino Essien
2301 Boulevard Granada, S.W.
Atlanta, GA 30311

JOSEPH EMERSON BROWN HIGH SCHOOL - SENIOR

"An Investigation of the Alignment of Fibers in Electric Fields" - L.H. Olson (T.E.)

*"A Study of the Effects of Electrical Fields in Forming Vortices in Flowing Fogs" - K.K-Y. Ko and J. Lundberg (T.E.)

Lisbeth R. Gibson
813 Parkway Drive, S.E.
Smyrna, GA 30080

F.T. WILLS HIGH SCHOOL - SENIOR

*"Synthesis of 18-6 and 14-4 Crown Ethers" - F.C. Cook (T.E.)

David Bodie Hurst
P. O. Box 284
Suwanee, GA 30174

NORTH GWINNETT HIGH SCHOOL - SENIOR

"A Study of the Strength of Temporary Paving Made of Precast Concrete" - J.S. Lai (C.E.)

James C. Knight
3 Schley Avenue
Savannah, GA 31406

SAVANNAH COUNTRY DAY SCHOOL - JUNIOR

"A Study Using a Computer for Optimum Pattern Packing: Fitting Rectangles in Rectangles" - J.L. Register & M. Konopasek (T.E.)

Veda J. Lamar
649 Hinson Avenue
Prichard, Ala. 36610

MATTIE T. BLOUNT HIGH SCHOOL - SENIOR

"A Gas Chromatographic Study of Organic Compounds in Waste Water from Carpet Manufacture" - W.C. Tincher (T.E.)

William Robert Lanigan
214 Salt Creek Road
Savannah, GA 31405

SAVANNAH CHRISTIAN SCHOOL - SENIOR

Michelle L. Lewis
Route 2
Donalsonville, GA 31745

SEMINOLE COUNTY HIGH SCHOOL - SENIOR

"A Study of the Use of Crown Ethers in Dyeing" - F. L. Cook (T.E.)

Alan Bruce Long
Route 5
Moultrie, GA 31768

MOULTRIE SENIOR HIGH SCHOOL - SENIOR

"A Study of Hydrogen as an Alternate Fuel in Internal Combustion Engines and Magnesium Hydride as a Hydrogen Carrier in a Supply System" - W.D. Freeston (T.E.)

Mary Carolyn Mathews
327 Kensington
Savannah, GA 31405

ST. VINCENT'S ACADEMY - SENIOR

"A Study of the Dyeing and Color Fastness of Fabrics Made of Cotton-Polyester Blends" - W. C. Carter (T.E.)

Sally Ann McRobert
1818 NE Vivion Road
Kansas City, MO 64118

NORTH KANSAS CITY HIGH SCHOOL - SENIOR

"A Study of the Tensile Strengths of Braids of Nylon Monofilaments"- A. Tayebi and M. E. Sikorski (T.E.)

Mark H. Murphy
Buchanan Road
Tallapoosa, GA 30176

HARALSON COUNTY HIGH SCHOOL - SENIOR

"A Study of the Strength of Temporary Pavement Made of Precast Concrete"- J. S. Lai (C.E.)

Clarissa Nelson
2340 Venetian Drive
Atlanta, GA 30311

SOUTHWEST HIGH SCHOOL - SENIOR

*"A Study of the Mechanical Properties of Human Hair: Effects of Time, Race, Sex, and Treatments"- B. R. Livesay (E.E.S.)

Randall R. Nordlund
35817 28th Avenue South
Federal Way, WASH 98002

FEDERAL WAY HIGH SCHOOL - SENIOR

"A Study of Stretch Receptors" - G. Anderson (Biol.) and R. Vito (E.S.M.)
"A Study of Creep in Leather" - A. Tayebi (T.E.)

DeAnna Kai Olive
111 Peyton Place, SW
Atlanta, GA 30311

SOUTHWEST HIGH SCHOOL - SENIOR

"A Study in Architectural Design: A Bath House" - A. F. Beckum (Arch.)

Minton L. O'Neal
904 Springhill Drive
Warner Robins, GA 31093

WARNER ROBINS HIGH SCHOOL - JUNIOR

"Angiography: A Study of Velocities of Blood Flow by Doppler Effect in Ultrasound" - D. P. Giddens (A.E.)

Kathleen H. Pelikan
6501 Bennockburn Drive
Bethesda, MD 20034

WALT WHITMAN HIGH SCHOOL - SENIOR

"Design and Construction of a Counter and Timer Activated by a Light Source for Measuring Shuttle Speed in Weaving and Rotation Rates in False Twist Texturing" - D. S. Brookstein (T.E.) and T. K. Gaylord (E.E.)

Walter Cowan Price
1291 Amanda Circle
Decatur, GA 30033

BRIARCLIFF HIGH SCHOOL - SENIOR

*"A Study of Thermal Conduction of and the Protection Afforded by Fabrics in Contact with Molten Metals" - W. D. Freeston and J. L. Lundberg (T.E.)

Katina V. Robie
93 Anderson Avenue, N.W.
Atlanta, GA 30314

H. M. TURNER HIGH SCHOOL - SENIOR

"A Study of the Environmental Impact of the Metropolitan Rapid Transit Authority: Accoustical Aspects" - D. O. Covault (C.E.)

Gary R. Rose
901 Stratford Hill Drive
Virginia Beach, VA 23452

FLOYD E. KELLAM HIGH SCHOOL - SENIOR

"A Study of the Effect of Agitation on the Strength, Consistency and Fastness of Recycled Paper"-E.M. Hartley (Ch.E

Rina Rub
2210 N.E. 211th Street
North Miami Beach, FL 33180

NORTH MIAMI BEACH SENIOR HIGH SCHOOL - JUNIOR

"Studies of Continued Fractions"- N. Chafee (Math.)

Patricia L. Sharrah
Route 1, Box 2221
Anderson, CA 96007

ANDERSON HIGH SCHOOL - JUNIOR

"Information Storage by Holography A Study of Angular Selectivity of Nonsinusordal Waves"- R. Magnusson and T. K. Gaylord (E.E.)

Mike O. Shoemaker
2215 Shady Lane
Huntsville, AL 35810

HUNTSVILLE HIGH SCHOOL - SENIOR

"Studies of the Physical Properti of Rubbers Cured for Various Time and the Devulcanization of Rubber" - W. C. Carter (T.E.)

Lawrence R. Shoemaker
2215 Shady Lane
Huntsville, AL 35810

HUNTSVILLE HIGH SCHOOL - SENIOR

"Studies of the Physical Properti of Rubbers Cured for Various Time and the Devulcanization of Rubber" - W. C. Carter (T.E.)

John M. Staak
2813 Helen Street
Augusta, GA 30909

ACADEMY OF RICHMOND COUNTY - SENIOR

"A Study of the Effect of the Concentration of Cobalt on the Adhesion of an Enamel to Low Carbon Steel" - J. K. Cochran, Jr (Cer.E.)

Laddeus L. Sutton
106 North Myrtle Street
Kinston, NC 28501

KINSTON HIGH SCHOOL - SENIOR

"Angiography: A Study of Velocities of Blood Flow by Doppler Effect in Ultrasound" - D. P. Giddens (A.E.)

Thaddeus G. Sutton
106 North Myrtle Street
Kinston, NC 28501

KINSTON HIGH SCHOOL - SENIOR

"A Study in Architectural Design: A Bath House"- A. F. Beckum (Arch.)

Linda S. Taylor
1273 Becket Drive
Atlanta, GA 30319

CHAMBLEE HIGH SCHOOL - SENIOR

*" A Study of the Concentrations in and Effects of Deuterium Oxide on Devils' Ivy by Observing Tritium Translocation by Liquid: Scintillation" - C. R. Allen and M. V. Davis (N.E.)

Laura R. Todd
300 Wood Bluff Road
Lafayette, LA 70503

LAFAYETTE HIGH SCHOOL - SENIOR

"Design, Construction and Testing of an Automobile Restraint System for Children" - W. D. Freeston (T.E.)

Ronald A. Ward
1125 MaGee Street
Prichard, AL 36610

MOLLIE T. BLOUNT HIGH SCHOOL - SENIOR

"Water Purification by Radiation from Cobalt-60" - G. G. Eichholz (N.E.)

Neal John White, III
3860 Whitehaven Drive
Smyrna, GA 30080

F. T. WILLS HIGH SCHOOL - SENIOR

"A Study Using a Computer for Optimum Pattern Packing: Filling Circles in Rectangles"- J. L. Register and M. Konopasek (T.E.)

Rolise L. Wolfe
3212 Amhurst
Atlanta, GA 30318

FREDERICK DOUGLASS HIGH SCHOOL - SENIOR

"A Study in Architectural Design: A Bath House - A. F. Beckum (Arch.)

Elizabeth Jane Wood
219 Hanson
Easton, MD 21601

EASTON HIGH SCHOOL - SENIOR

"A Study of the Dyeing of Natural Fibers, Sisal, Cotton, and Wool" - W. C. Carter (T.E.)

Alesia Kay Williams
RR 2, Lightfoot Road
Harbor Springs, MI 49740

HARBOR SPRINGS PUBLIC HIGH SCHOOL - SENIOR

"A Study of the Preparation of Carbon Fibers from Rayon"- F. C. Cook and D. S. Brookstein (T,E.)

*Denotes projects on which students are continuing their investigations. Most of these will be entered in local and national competitions.

III. The Program

A. Research

The purpose of the program was to introduce students to research in engineering and science and to help them carry on research of some value. Fourty four (44) student participants worked on forty two (42) different research problems. Thirty four (34) research advisers from twelve schools at Georgia Tech, Aerospace, Ceramic, Civil, Electrical, Nuclear and Textile Engineering, Engineering Science and Mechanics, Information and Computer Sciences, and Biology, Chemistry and Mathematics, from the College of Architecture, and from the Engineering Experiment Station helped the students with their research.

The diversity of research projects was at least as great as in past years. Most projects were multidisciplinary. A breakdown of principal disciplines and major subjects, and materials involved is as follows:

Disciplines Involved	Number of Projects	Major Subjects and Materials Involved	Number of Projects
Engineering	20	Environment	6
Chemistry	14	Computing	4
Physics	6	Nuclear science	4
Life Sciences	3	Energy	2
		Polymers	3
		Textiles	10

The emphasis this year on engineering is gratifying because high school students are more familiar with life sciences and chemistry than with engineering. Therefore, they tend to select projects in these more familiar disciplines. High school students usually study

biology first, chemistry second, and physics last, often in their senior years after participating in an SST program.

We want as great diversity as is possible in research problems among the students. They learn more from each other than from faculty. If the range of research subjects is great, the participants teach each other a wide range of subjects. Some exposure to a wide range of science and engineering is essential if students are to become interested in the fascinating and vital but less known areas of science and engineering. Lack of exposure to diversity coupled with too early specialization prevents young scientists and engineers from contributing to less known, fertile areas of need in science and engineering. We cannot afford to let the less known areas languish; often these are the areas of likely breakthrough. The well known and spotlighted areas of science and engineering tend to be overworked. Exposure to diversity should begin early.

Fair to good results were obtained in many of the research projects. Results will be published in years to come as continuing work is completed.

We put the students on their own as far as tending to their research. Of course we encourage them and help them, but we don't lead them by the hand. Some students don't accomplish as much as they should, but almost all who aren't as diligent as they should be learn from this mistake. In our program, participants make part of that change from structured program, dependence upon close supervision and being pushed, and home to diversity of opportunity, independence and need for self-motivation, and living in a university; most respond and perform well.

The names of students, research problems and research advisers are given on pages 8 through 12.

Research advisers for student participants were as follows:

Name	Degree	Position	School or Org.	Specialty
C. R. Allen	MS (EE)	Grad. Res. Asst.	Elect. Engrg.	Optics, information storage
G. L. Anderson	PhD (Biol)	Asst. Professor	Biology	Muscle functions
R. D. Barksdale	PhD (CE)	Professor	Civil Engrg.	Soil mechanics
A. F. Beckum	MFA (Arch)	Professor	Architecture	Architectural design
D. S. Brookstein	ScD (ME)	Asst. Professor	Textile Engrg.	Textile and mech. engineering
W. C. Carter	PhD (Chem)	Professor	Textile Engrg.	Polymer and textile chemistry
N. Chafee	PhD (Math)	Assoc. Professor	Mathematics	Analysis
J. K. Cochran	PhD (Cer E)	Assoc.Professor	Ceramic Engrg.	Crystallography, glazes
F. L. Cook	PhD (Chem)	Asst. Professor	Textile Engrg.	Organic and textile chemistry
D. O. Covault	PhD (CE)	Professor	Civil Engrg.	Transportation
M. V. Davis	PhD (Phys)	Professor	Nuclear Engrg.	Reactor operation and design
G. G. Eichholz	PhD (Phys)	Regents' Prof.	Nuclear Engrg.	Nuclear science
R. W. Fink	PhD (Chem)	Professor	Chemistry	Nuclear chemistry
J. M. Florence	MS (EE)	Grad. Res. Asst.	Elect. Engrg.	Laser optics
W. D. Freeston	PhD (ME)	Prof and Director	Textile Engrg.	Mechanics
T. K. Gaylord	PhD (EE)	Assoc. Professor	Elect. Engrg.	Optics
D. R. Gentry	PhD (Mgmnt)	Assoc. Professor	Textile Engrg.	Fiber properties
D. P. Giddens	PhD (A.E.)	Assoc. Professor	Aerospace Engrg.	Bioengineering
E. M. Hartley	PhD (Ch.E.)	Assoc. Professor	Chemical Engrg.	Paper and pulp
M. Konopasek	PhD (Phys.)	Assoc. Professor	Textile Engrg.	Mechanics and computers
K. K-Y. Ko	MS (Chem)	Grad. Res. Asst.	Textile Engrg.	Polymer and phys. chemistry
J. S. Lai	PhD (Mech)	Assoc. Professor	Civil Engrg.	Mechanics, materials
B. R. Livesay	PhD (Met)	Senior Res. Sci.	Engrg Exp. Sta.	Mechanics and metals phys.
J. L. Lundberg	PhD (Chem)	Callaway Prof.	Textile Engrg.	Polymer chem. and phys.
R. Magnusson	PhD (EE)	Postdoctoral Fellow	Elect. Engrg.	Optics, information storage
H. M. Neumann	PhD (Chem)	Professor	Chemistry	Inorganic and phys. chem.
L. H. Olson	PhD (Phys)	Assoc. Professor	Textile Engrg.	Mechanics and fiber science

Name	Degree	Position	School or Org.	Specialty
J. L. Register	MS (ICS)	Grad. Res. Asst.	Information & Computer Sci.	Computing
W. T. Rhodes	PhD (EE)	Assoc. Professor	Elec. Engrg.	Optics
M. E. Sikorski	MS (Phys)	Research Engr.	Textile Engrg.	Mechanics
A. Tayebi	ScD (ME)	Assoc. Professor	Textile Engrg.	Mechanics and processing
W. C. Tincher	PhD (Chem)	Professor	Testile Engrg.	Polymer and textile chem.
R. Vito	PhD (Mech)	Asst. Professor	Engrg. Sci. & Mech.	Biomechanics
J. E. Weaver	MS (EE)	Grad. Res. Asst.	Elect. Engrg.	Computers

Abbreviations used in affiliations of research advisers are as follows:

AE = School of Aerospace Engineering
Arch = College of Architecture
Biol = School of Biology
CerE = School of Ceramic Engineering
ChE = School of Chemical Engineering
Chem = School of Chemistry
CE = School of Civil Engineering
EE = School of Electrical Engineering
EES = Engineering Experiment Station
ESM = School of Engineering Science and Mechanics
ICS = School of Information and Computer Sciences
Math = School of Mathematics
NE = School of Nuclear Engineering
TE = School of Textile Engineering

Of this group of thirty four (34) research advisers, eleven (11) are senior faculty members (professors), fifteen (15) are assistant or associate professors,one is a senior scientist, one is a research engineer, one is a postdoctoral fellow, and six are graduate research assistants. All members of the academic community should work with the participants of our SST program; each has special talents and advantages of experience, perspective, credibility, empathy, enthusiasm, communication, etc. which must be used. Research advisers in our 1977 program ranged in age from 22 to about sixty. Unfortunately, we had no women and no blacks in this

group, though natives of Asia and Europe are included.

We believe that involvement of senior faculty is essential to the success of our SST program. Without Professors Carter, Freeston, and Tincher of the School of Textile Engineering, the program could not function. These senior faculty members serve as research advisers, seminar and discussion leaders, tutors, counselors, chaueffeurs, and recreation leaders. Professors Richard Fink and Henry Neumann of the School of Chemistry, Professor Donald Covault of the School of Civil Engineering, and Dr.Geoffrey Eichholz, Regents' Professor, and Professor Monte Davis of the School of Nuclear Engineering have provided some of the most interesting and rewarding research opportunities for our participants. Each of these faculty members has participated in our SST program for two or more years. In 1977, Professor Arthur Beckum of the College of Architecture worked with three student participants in architectural design projects. Students are sensitive enough to determine quickly the degree of interest in and commitment to teaching of faculty members. Because senior faculty members show that they care for students and participate in the SST program, student participants return to Georgia Tech as undergraduates.

Dr. B. R. Livesay of the Engineering Experiment Station has served as research adviser for no fewer than ten participants in Georgia Tech's SST programs in the last five years. His contributions in micromechanics of fibers and fiber assemblies including systems of biological interest and in magnetic properties have increased the scope of and interest in our SST programs.

Professors David Brookstein, Fred Cook, David Gentry, Milos Konopasek, and Amad Tayebi of the School of Textile Engineering have served in every possible capacity in making Georgia Tech's SST programs successful. These men have been involved in the SST programs for two to five years. The SST programs would have been much the poorer without Professors Brookstein and Tayebi's contributions in mechanics, mechanical processes, and energy studies; Professor Cook's discussions and projects in organic, polymer, and textile chemistry; Professor Gentry's leadership in fiber, textile, and management studies,and Professor Konopasek's work with students in computing, textile engineering, and applied mathematics, mechanics, and geometry problems.

Professor Tom Gaylord of the School of Electrical Engineering has served as a research adviser for two years. He has welcomed students into his busy and productive laboratory in laser optics and has helped them to complete significant research projects. Professor Don Giddens of the School of Aerospace Engineering has been an SSTP research adviser for three years. He has introduced eight SSTP participants to bioengineering through fascinating research projects on blood flow and the effect of turbulence in laboratory and clinical studies.

Matthew Sikorski, Research Engineer in the School of Textile Engineering, has been"the other research adviser"for at least twenty SSTP participants in the last two years. In his capacity as supervisor of the School's testing and microscopy laboratories, he has introduced several students to electron and optical microscopy, mechanical measurements transducers, and the whole array of tests for fibers and textiles.

Ludmilla Konopasek, Research Engineer, helped several of the 1977 SSTP participants with electron microscopy and mechanical measurements. Mr. David Rawlings, machinist, designer, and deft operator of complicated equipment, helped about half of our 1977 SST participants with some part of their research projects. In addition he was the helper and adviser in the laboratory in Laura Todd's excellent study of an automobile restraint system for childen.

At least six of the 1977 SSTP participants are continuing to work on their research problems. These are Marcelino Essien (Atlanta), Lisbeth Gibson (Smyrna), Clarissa Nelson (Atlanta), Cowan Price (Decatur), Linda Taylor (Atlanta), and Neal White (Smyrna). Of these, four will enter competitions. Based upon experience from past years, another three to six participants are continuing their work and will enter competitions.

B. Seminar & Demonstrations Program

Seminars and demonstrations followed closely those outlined in the proposal. Forty three seminars in science, engineering, and mathematics centered around polymer, fiber,and textile science and engineering were present by members of the faculty of the school of textile engineering. Other seminars included one in counselling, one in English composition, two on computing systems, and one in laboratory safety. Seminars and demonstrations accounted for 65 to 70 hours of scheduled time. In the last week of the program, five (5) seminars were devoted to student participants reports on their research. Faculty members and research advisers

sat in for reports in which they were involved or interested. Participants were required to attend these seminars and seminars which are listed in Appendix II, pages 49 through 51.

Seminar leaders and demonstrators were the following eleven faculty members and one staff member of the School of Textile Engineering and Dr. Barbara Winship and Thomas Parker of the Counselling Center and Professor James Bynum of the English Department.

Name	Degree	Position	Specialty
C. Anderson	B.S. (Text)	Asst. to the Director	Counselling incoming students
D. S. Brookstein	Sc.D (M.E.)	Asst. Professor	Textile & mechanical engineering
J. J. Bynum	Ph.D (Engl.)	Assoc. Professor & Asst. Dean, Grad. Div.	Composition, Am. literature.
W. C. Carter	Ph.D. (Chem)	Professor	Polymer & textile chem.
F. L. Cook	Ph.D. (Chem)	Asst. Professor	Organic & textile chem.
W. D. Freeston, Jr.	Ph.D. (M.E.)	Prof. & Director	Mechanics & textile engineering
D. R. Gentry	Ph.D. (Mgmnt)	Associate Professor	Fiber science & management
M. Konopasek	Ph.D. (Phys)	Assoc. Professor	Mechanics & computing
J. L. Lundberg	Ph.D. (Chem)	Callaway Professor	Polymer science
L. H. Olson	Ph.D. (Phys)	Assoc. Professor	Textile & fiber physics
Thomas A. Parker	M.A. (Cnslg)	Counselor	Counselling
A. Tayebi	Sc.D. (M.E.)	Asst. Professor	Mechanics & textile engineering
Walter Thomas, Jr.	M.S. (Text.)	Asst. Professor	Textile processing
W. C. Tincher	Ph.D. (Chem)	Professor	Polymer & textile chem.
Barbara J. Winship	Ph.D. (Psycho)	Asst. Dir., Counselling Center	Counselling

C. Colloquia

Seven colloquia with speakers from other schools or from off campus were presented. Participants were expected to attend colloquia.

About twelve hours were devoted to colloquia. Speakers, affiliations, and subjects were as follows:

"Ceramics and Glasses," Professors A. T. Chapman and J. K. Cochran, School of Ceramic Engineering, Georgia Tech.

"Mathematics - Useful Results and Pure Fun," Professor Nathaniel Chafee, School of Mathematics, Georgia Tech.

"Animal Behavior: Experiments with the Great Apes," Professor R. K. Davenport, School of Psychology, Georgia Tech, and Yerkes Primate Laboratory, Atlanta.

"Communications and Materials: Fiber Optics" (with demonstrations including transmission), Dr. George Yanizeski, Bell Laboratories, Atlanta.

"Nuclear Engineering," Professor G. G.Eichholz, School of Nuclear Engineering, Georgia Tech.

"Some Opportunities in Industry and Government, etc." - Dr. James E. Bostic, Jr., Riegel Textile Corporation, Ware Shoals, S.C. (formerly Deputy Assistent Secretary of Agriculture).

"Engineering Science and Mechanics," Professor Milton Raville, Director, School of Engineering Science and Mechanics, Georgia Tech.

D. English Clinic

Professor James Bynum of Georgia Tech's English Department conducted one seminar on English. He explored with the student participants our need for good command and use of written English. Professor Bynum offered to read and analyze themes which the students might write. Several participants wrote themes on familiar subjects. Professor Bynum analyzed these and returned them to the students with comments. Several of the members of the Georgia Tech faculty believe that English is the most important subject in all curricula at Georgia Tech. We continually encourage

our students to improve their use of the language; we do the same in our SST program.

E. Computing Seminars

Mr. Rand Childs, Systems Analyst in the Office of Computer Services at Georgia Tech, arranged guided tours of the computing facilities; students went in two groups on the third day of the program. On the same day, Professor Milos Konopasek led a working seminar on computers and began to introduce students to the small computers and the remote stations in the School of Textile Engineering. He continued this on the fifth, sixth, and seventh days of the program on an optional basis.

Mary Trauner, Systems Analyst in the Office of Computer Services at Georgia Tech, conducted four (4) two hour sessions on computing, chiefly use of the Control Data Corporation "Cyber 74" system, PDP-8 computers, and the "Calcomp" plotter. Attendance at these computer seminars was voluntary. In addition, Miss Trauner and other members of the Georgia Tech Computer Center's staff served as willing programming counselors to introduce our SSP participants to computing. All students were provided with necessary account numbers, identification, etc. so that they could use the computing facilities at Georgia Tech. About one third of the students did use the computers; a few became adept at computing and playing computer games.

Professor Milos Konopasek and Mr.Craig Anderson introduced SSTP participants to the remote access terminals to the big computer on campus and to the small computers in the School of Textile Engineering. Professor

Konopasek offered as much time and help as students desired in learning to use his question and answer system and to learn programming and use of the large "Cyber-74" computer. Mr. J. L. Register assisted in this teaching of computing.

F. Counseling

Dr. Barbara Winship and Mr. Thomas Parker of the Student Counseling Center at Georgia Tech met with the students the second day of the program. Two weeks later the participants visited the Counseling Center; Dr. Winship and Mr. Parker met with and spoke to them. In this way, participants became aware of some of the help available from these dedicated and able psychologists. In their discussions, Mr. Parker and Dr. Winship discussed the transition from home to college life the participants were experiencing and would face again in a little over a year, some of the ways to develop effective study habits, and how the participants might help themselves to enrich their experience in our SST program. Mr. Parker was particularly helpful in communicating with some of the minority group participants.

G. Special Seminars on Advanced Subjects and Seminars Requested by Student

Special seminars on mechanics, thermodynamics, quantum mechanics, statistical thermodynamics and subjects requested by student participants were offered. From about six to twenty students participated.

Professor Amad Tayebi's special seminars on continuum mechanics were particularly well received. Dr. Tayebi is a superb teacher. He has been most successful in introducing students to continuum mechanics, a subject omitted in courses in physics and from too many college curricula. Professor Tayebi's seminars were:

A1. "Mechanics: Introduction to Stress and Strain and the Analysis of Stress and Strain" - June 23, 1977

A2. "Torsion, Shear Force and Bending" - June 29, 1977.

A3. "Bending, Stiffness, and Deflection of Beams" - July 20, 1977.

A4. "Friction, Work, etc" - July 28, 1977

Special seminars in advanced subjects in physics and chemistry included:

B1. "Newton's Mechanics and Conservation of Energy" - June 22, 1977.

B2. "Thermodynamics - First Law" - June 27, 1977

B3. "Thermodynamics - Second Law" - June 30, 1977.

B4. "Thermodynamics - Carnot Efficiency" - July 11, 1977.

B5. "Thermodynamics - Energy, Work and the Crunch" - July 18, 1977.

B6. "Quantum Mechanics by Planck" - July 25, 1977.

B7. "Wave Mechanics" - August 1, 1977.

J. L. Lundberg led these seminars. Students were given extensive notes.

The student participants requested additional seminars in mathematics. Voluntary attendance was from about eight to twenty plus students. These seminars led by J. L. Lundberg were as follows:

M1. "Differentiation" - July 12, 1977.

M2. "Algebra" - July 21, 1977.

M3. "Algebra Continued" - July 27, 1977.

Students like calculus; they need algebra. Therefore, emphasis was turned to algebra. Participants were encouraged to buy books on algebra, trigonometry, and analytical geometry and to start working problems; several students did so.

H. Field Trips and Visits

On June 23 and 24, 1977, student participants visited the Coca Cola Company's bottling works near the Georgia Tech campus. This short one-hour visit was most rewarding. The visits alternated with visits to Georgia Tech's School of Civil Engineering.

The group visited the Fernbank Science Center on Thursday evening July 14, 1977. They heard and saw a special demonstration of the planetarium, the observatory, and a slide show on the planets and other bodies which revolve about our sun. Mrs. Caye Bedford was the discussion leader and hostess; her demonstration of the planetarium was so fascinating that our students asked questions to the extent that we left at 10:30 p.m., a half hour later than the scheduled closing of the center. The Fernbank Science Center is a department of the Division of Instruction of the DeKalb County School System.

We visited Callaway Gardens at Pine Mountain, Georgia, on Saturday, July 16, 1977. Dr. Robert A. Pedigo, Director of the Education Department of Callaway Gardens, introduced students to the gardens by a slide show and short lecture. He then conducted an extensive tour of the gardens with discussions and questions. A few of the students really appreciated the beautiful reclamation of worn-out cotton land and the fine developments in applied botany exemplified by Callaway Gardens.

Our SSTP students visisted the nylon manufacturing plant of the American Enka Company at Central, South Carolina, on July 26, 1977. Here they learned about and saw polymerization of caprolactam to nylon 6; the purification of nylon 6; fiber spinning, drawing, and texturing; laboratory

testing and fabric and carpet making, dyeing, and evaluation. On the same trip they visited the Duke Power Company's Oconee Station, a nuclear-hydroelectric complex with three reactors and steam generators, three lakes at different levels, and water conduits and generator and pumping systems. We were on the power house floor when one of the three mammoth generators was delivering about $0.8 \cdot 10^9$ watts. Here we gained some appreciation of how much energy we use and to what extremes we must go to satisfy our needs.

All students visited the following schools, centers, and facilities on the Georgia Tech campus:

Date	SITE		HOSTS
June 20	Georgia Tech Library	-	Professor Frances Kaiser, Librarian
June 20	Student Center for ID Cards	-	
June 20	School of Textile Engineering Labs	-	Craig Anderson, Assistant to the Director
June 21	School of Chemistry	-	Professor J. Aaron Bertrand, Director, and Professor James A. Stanfield, Assistan Director
June 21	School of Ceramic Engineering	-	Professor Joseph L. Pentecost, Director, and Professor Joe K. Cochran
June 21	Georgia Tech Nuclear Reactor	-	Professor Monte V. Davis, Director
June 22	Georgia Tech Computer Center	-	Rand H. Childs, Systems Analyst
June 23	School of Physics	-	Professor Donald C. O'Shea
June 23, 24	School of Civil Engineering	-	Professor Paul G. Mayer

Date	SITE	HOSTS
June 24	School of Electrical Engineering	Professors David L. Finn and Thomas M. White
June 24	Engineering Experiment Station	J. L. Brown, J. A. Donavan, and E. L. Meeks, Senior Staff Members
July 7	Georgia Tech Counselling Center	Dr. Barbara J. Winship and Thomas A. Parker, Counselors

In each of the visits, extensive demonstrations, briefings as to function, and question and answer sessions were provided. Professor Frances Kaiser's introduction to the library is excellent; the participants could use the library and check out books starting on the first working day of the program, Monday June 20th. The visit to the Engineering Experiment Station included a slide show presentation showing the diversity of activities (by Mr. J. A. Donavan), a vist to and demonstration of electron microscopy facilities (Mr. J. L. Brown), and a visit to the laboratories and demonstration of the techniques of microcircuitry in the semiconductor laboratories (Dr. E. L. Meeks).

I. Science Movies

Motion pictures on science and engineering were shown four nights weekly in the first two weeks and the fifth and sixth weeks of the program. Attendance was optional. A list of movies shown is given in Appendix III.

J. Recreational and Group Activities

SSTP participants enjoyed fifteen (15) recreational and group activities in the 48 days from Sunday, June 19th, through Friday, August 5th. Average intervals between activities was three days; the longest

interval was seven days. Teenage young people need and want both planned, group recreation and unstructured, unplanned activities. Campus recreation facilities and teen-age creativity combine to provide sufficient of the latter. The new Student Athletic Complex at Georgia Tech was a real attraction for SSTP participants as it is for the students and faculty. This large and varied facility is for students, not for intercollegiate athletics.

The Atlanta Symphony Orchestra plays in Symphony Hall close to the Tech campus. A few students attended concerts there. As part of the summer program of the Atlanta Parks and Recreation Department, the Atlanta Symphony gave five concerts on early Sunday evenings in nearby Piedmont Park. These delightful family picnic concerts were well attended. Our SSTP participants enjoyed three of these concerts taking picnic suppers along on two occasions..

Motion pictures are shown on campus on Friday evenings during the summer. On Saturdays, when no group activity was planned off campus, the students had informal parties in the lobby of the School of Textile Engineering. Mr. Craig Anderson and the faculty members supervised these social activities. No funds provided by the Foundation can be or were used in any way to support recreational or group activities. A listing of these activities is given in Appendix IV.

K. Communication

Communications among participants, staff and faculty were good in 1977. Of course gaps did exist; we do not listen carefully to one another. To facilitate communication we used the following channels: 1. Weekly

programs (schedules) were provided to each student. 2. Orientation and question and answer sessions were held by faculty members, Mr. Craig Anderson, and student dormitory counselors, Miss Beverly Hancock and Mr. Keith Jones. 3. Meetings among SSTP participants, Georgia Tech students, faculty, staff, and participants in our past SST programs in the lobby of the Textile Engineering Building. 4. Visits by Mr. Anderson and faculty members to dormitories. 5. Faculty members and SSTP participants eating together at lunch and supper. 6. Faculty members keeping open the doors to their offices and visiting laboratories to talk to and help participants. 7. Keeping contact with Dr. Barbara Winship and Mr. Tom Parker in the Counselling Center. A few students would communicate with these counselors but not other Tech personnel.

Mr. Craig Anderson lived on campus in the same dormitory in which the boys were housed and close to the dormitory in which the girls lived. His presence and the relative ease with which students communicate with him contributed much to our improved communications in 1977.

IV. Results of the Program: Evaluation

A. General

The 1977 SST program was our fifth, annual program at Georgia Tech. One participant from our first program who came to Tech has graduated; several are close to graduating, others are juniors and seniors. Those from the second program are sophomores and juniors. Participants in the third and fourth programs are freshmen and sophomores. We have observed closely the performance of these students at Tech; they have done well (GPA from 2.2 to 4.0 out of 4.0). A few have done excellent work in undergraduate research. Based upon their performance to date and upon

past participant statements we believe that our 1973 - 1976 programs were successful and that our 1977 program will have served the best yet in developing science and engineering students. One participant in the 1977 program is in school at Tech in the joint enrollment program.

B. Assessment of Research Results in the 1977 Program

The program director graded the research activity of each of the participants for this report. Grades are based on: 1. students' research reports, 2. estimates of performance by research advisers, 3. observations of and conversations with participants in the laboratories, and 4. general impressions by faculty members, other students' research advisers and the program director. Estimates of research performance compared to estimates of abilities of applicants (as given in Table I, page 7) are given in Table II. Estimates are grouped for participants with good to excellent opportunity and encouragement to study science, those with limited opportunity and/or encouragement, and for all participants. (The grade, "Good", with grade point 2.0 (C) is characteristic of abilities and work of students whom we would welcome to Georgia Tech as students of engineering, science, or mathematics).

Table II

Comparison of Estimates of Students Abilities with Estimates of Their Research Performance, 1977 SST Program

Group	Estimated Potential as Applicants	No. of Students	Superior A=4	Excellent B=3	Good C=2	Fair D=1	Poor F=0	Avera GPA
Good to Excellent Opportunity	Gifted (A=4)	4	1	1	2	0	0	2.75
	Very Good (B=3)	9	5	4	0	0	0	3.56
	Good (C=2)	11	3	5	2	1	0	2.91
	Fair (D=1)	2	0	1	1	0	0	2.50
	Poor (F=0)	0	0	0	0	0	0	
	Average/Total	2.58/26	9	11	5	1	0	3.08

Group	Estimated Potential as Applicants	No. of Students	Superior A=4	Excellent B=3	Good C=2	Fair D=1	Poor F=0	Averag GPR
Limited Opportunity	Gifted (A=4)	0	0	0	0	0	0	
	Very Good (B=3)	7	3	2	1	1	0	3.00
	Good (C=2)	6	0	4	2	0	0	2.67
	Fair (D=1)	4	0	1	3	0	0	2.25
	Poor (F=0)	1	0	0	1	0	0	2.
	Average/Total	2.06/18	3	7	7	1	0	2.67
Rising Juniors	Gifted	1	1	0	0	0	0	4.
	Very Good	3	2	1	0	0	0	3.67
	Good	3	0	2	1	0	0	2.67
	Fair	0	0	0	0	0	0	
	Poor	0	0	0	0	0	0	
	Average/Total	2.71/7	3	3	1	0	0	3.29
All Students	Gifted	4	1	1	2	0	0	2.75
	Very Good	16	8	6	1	1	0	3.31
	Good	17	3	9	4	1	0	2.82
	Fair	6	0	2	4	0	0	2.33
	Poor	1	0	0	1	0	0	2.
	Average/Total	2.36/44	12	18	12	2	0	2.91

The seven students whose potential was estimated as poor (F=0) to Fair (D=1) performed beyond expectations. On the average, students with limited opportunity and/or encouragement in science did better in their research than we expected, performance GPR $\sim$ 2.7 compared to expectations GPR $\sim$ 2.1. Students with good to excellent opportunity performed (GPR$\sim$3.1) better than expected (GPR$\sim$2.6). The seven (7) rising juniors who participated in the program did exceptionally well; their performance (GPR$\sim$3.3) was better than the predicted performance (GPR$\sim$ 2.7). The thirty seven (37) rising seniors' predicted performance was GPR$\sim$ 2.3; their actual performance was better than this GPR $\sim$ 2.8. No participants did poor work (F=0); two were only fair (D=1) in their research. Each year we become more critical

in grading participants' performance because students show us how well they can do in their research; each year's participants set higher standards for those who follow. We believe that we made no overestimates. We try to judge SSTP participants on the same basis we try to measure research performance of Georgia Tech undergraduates in special problems courses. Estimates of potential are the same as those for entering freshmen; we make no allowance for difference in age and years of schooling.

Comparison of estimates of ability and performance supports our belief that the necessary and almost sufficient condition for success is desire; ability as measured by tests and grades is secondary. Of course, class rank often correlates with desire. Based on exam scores one or two of the participants should not enter college. Of these both did good work (C=2) in their research. Both of these participants appear to be likely prospects for college; neither probably should start in an engineering school like Georgia Tech.

Our estimates of average potential of and performance by participants in the last three SST programs at Georgia Tech are:

Year	Number of Participants	Estimated Potential	Estimated Performance
1974		2.5	2.5
1975	37	1.8	2.6
1976	53	2.0	2.6
1977	44	2.4	2.9

In 1977 we had fewer "gifted" prospects than in 1974 or 1976. In 1977 we had more in number and a greater fraction in the "good" and "very good" categories. Faculty and staff concensus is that our 1977

group was the best yet and that the 1976 group was better than the 1975 or the 1974 groups. Again in 1977 we had few "gifted", lazy participants.

The participants in the 1977 SST program profited from it. Almost all worked at least reasonbly hard; none "goofed off" completely. In this respect, the 1977 group was as good or better than the 1975 and 1976 groups and much better than the 1974 group. Almost all participants in our 1977 program can "make it" in college; they are good prospects. Most of the participants can do well in engineering or science.

In 1977, three participants worked on architectural design products. One of the three shows promise as an architect. While architectural problems fall outside the scope of science and engineering, these can be most fruitful in encouraging young people toward science and engineering. One or two of the three who worked on these problems "got architecture out of their systems". This is important; about three out of four prospective freshmen who inquire about Georgia Tech express their interest in architecture. We believe that this is because students believe that they can combine art and engineering with some science in architecture. In any case, we graduate many more architects than are needed in architecture. Some fraction of the would-be artchitects can become good engineers and scientists.

Outstanding research problems in 1977 were as follows:

David I. Brown, II, "A Study of the Gamma Ray Spectra of Bismuth-207" - R. W. Fink (Chem)

Michael D. Chapman, "Identification of Trace Elements in Tobacco by Neutron Activation Analysis" - C. R. Allen and M. V. Davis(M

Harry D. Colley, "Synthesis of Complex Ions and Neutral Complexes of Cobalt, Nickel, and Molybdenum" - H. G. Neumann (Chem)

John Jefferson DeGange, "Studies of Film Densitometry and Film Diffusers for Use in Laser Optics" - J. M. Florence and W. T. Rhodes (EE)

Sally Ann McRobert, "A Study of the Tensile Strengths of Braids of Nylon Monofilaments" - A. Tayebi and M. E. Sikorski (TE)

Clarissa Nelson, "A Study of the Mechanical Properties of Human Hair: Effects of Time, Race, Sex, and Treatments" - B. R. Livesay (EE

Minton L. O'Neal, "Angiography: A Study of Velocities of Blood Flow by Doppler Effect in Ultrasound" - D. P. Giddens (AE)

Gary R. Rose, "A Study of the Effect of Agitation on the Strength, Consistency, and Fastness of Recycled Paper" - E. M. Hartley (ChE)

John M. Staak, "A Study of the Effects of the Concentration of Cobalt on the Adhesion of an Enamel to Low Carbon Steel" - J. K. Cochran (CerE)

Linda S. Taylor, "A Study of the Concentrations in and the Effects of Deuterium Oxide on Devils' Ivy by Observing Tritium Translocation by Liquid Scintillation" - C. R. Allen and M. V. David (NE)

Laura R. Tood, "Design, Construction and Testing of an Automobile Restraint System for Children" - W. D. Freeson (TE)

Elizabeth Jane Wood, "A Study of the Dyeing of Natural Fibers, Sisal, Cotton and Wool" - W. C. Carter (TE)

Of these, Clarissa Nelson and Linda Taylor are continuing their studies and will enter these in local and national competitions. Miss Lisbeth R. Gibson has continued her studies of "Synthesis of 18-8 and 14-4 Crown Ethers" with Professor F. L. Cook (TE). She has been at Georgia Tech for the fall quarter of 1977 in the joint enrollment plan taking three credit hours of Text-4900 Special Problems, a senior level research course. Miss Gibson's project now merits description as outstanding.

C. Students' Evaluation of the Program

Students evaluations of the Georgia Tech SST program were favorable, perhaps more than they should be. The thirty-four (34) responses to the questionnaire in Appendix V (with numerical results) permit us to conclude:

1. The forty eight seminars in the 1977 program were about right in number.
2. Although students are programmed for 50 minute classes; the 1 1/2 hour seminars were not too long for the 1977 participants.
3. Freshmen to junior levels in college probably is about the right level for seminars. Most students much "reach" for understanding most of the time; they should have to if they are learning.
4. Seminars of greatest interest to students ranged over a variety of subjects from mathematics and mechanics to a "dog and pony" show on textiles and polymers and chemistry, nuclear engineering and computers.
5. Subjects of least interest included textiles, polymers, chemical bonding, thermodynamics, dyeing and fibers. Except for mathematics, similar subjects by the same seminar leaders appear in both most and least interesting categories; this may be due to the diversity of interest of students in the program.
6. Most participants thought that seven "outside" speakers was the right number; a strong minority wanted more colloquia.
7. A few students would welcome more material in seminars; most thought we covered the right amount of material.
8. Apparently we offer sufficient research problems to satisfy diverse interests of participants.
9. Students rated faculty assistance in research as excellent; very few found faculty less than helpful.
10. Most students found procuring materials and instruments to be easy; for a few this was difficult.

11. The same amount of time should be devoted to research.

12. More or the same amount of time should be devoted to familiarizing participants with Tech's research and recreational facilities. Such help was available to all on individual or small group basis.

13. The time spent to familiarize students with Georgia Tech's instructional, resource, research and service facilities was about right.

14. Students like organized outings; time, financial resources, and stamina of faculty and staff limit these. In 1977, students thought we had enough organized outings.

15. The trip to Six Flags over Georgia was the favorite outing; this has been the favorite outing in past years. Visiting Underground Atlanta was least favored.

16. The 1977 student participants had sufficient free time.

17. Athletics, research,reading, and visiting Atlanta were listed as favored activities.

18. Most students liked our SST program as it was run in 1977, or with a few changes.

19. We should continue to emphasize research.

D. Good Points of the Program

Research was our chief activity; the fun of research and satisfaction from accomplishment were the most cited "good things" in the program. Most participants got real results in their work. A few projects with significant results are listed on pages 33 to 34.

Each year we can offer a greater diversity of research problems and find research advisers for a wider range of research suggested by

participants. This is thanks to enthusiastic participation by colleagues in other schools and centers at Georgia Tech. In 1977, projects in architectural design were offered for the first time thanks to Professor Arthur Beckum accepting our participants along with his sophomore design students. With greater diversity of research problems, special seminars in advanced chemistry and physics, visiting colloquium speakers, and additions to variety of material presented in the seminar program, our program has become more diverse (interdisciplinary or multidisciplinary in current jargon). We find that students learn chemistry and physics at least as easily using macromolecular systems with reference state a partially ordered composite structure as using the usual small molecule compounds with the ideal gas and sodium chloride crystal as reference states.

Colloquia with outside speakers were well received. For the fifth year, Dr. James E. Bostic of the Reigel Textile Company and formerly Deputy Assistant Secretary of Agriculture, came to visit and lead a discussion in our SST program. Dr. Bostic is a favorite with the students; each year they quiz him for about two hours on a wide variety of subjects.

Our colloquium speakers included one minority member. Judging from our students' reactions and comments, including at least one minority member, who communicates well with people, is essential.

Dr. James Bynum's contributions in helping participants appreciate the importance of English and to write better were needed and appreciated. By the second week participants knew that English is their most important subject.

Students used the computers as much in 1977 as in previous years. Serious, useful computing increased. Nine participants used computers

extensively in their research. Miss Mary Trauner of the Computer Center and Professor Milos Konopasek of the School of Textile Engineering were most effective in introducing participants to computing.

Professor Amad Tayebi's special seminars on mechanics were superb and popular. Special seminars on Newton's mechanics, thermodynamics, quantum mechanics and statistical thermodynamics were well received. From ten to fifteen students participated. High school students seem to understand Max Planck quite well; we used his 1901 paper as text material. Students particularly appreciated the three special seminars on mathematics which they requested. We try to minimize the seminar time on subjects which are college preparatory or offered in high school or college.

Nature knows no disciplines; she needs no interdisciplines. Introducing students to science, engineering and math in this manner is easy. Comments from past participants about this and the ease with which 1977 participants learned give credence to the thesis that teaching math, science, and engineering together with many examples familiar to the students makes easier the learning and gives relevance to otherwise abstract ideas. Too often we forget that nature and students do not require and the latter do not appreciate dividing studies into disciplines; rather, these artificial divisions hamper learning.

Many students are sheltered to the extent that they haven't been in a factory, for example. Therefore, the visit to the nylon plant and the nuclear power station is a real "eye opener."

Miss Beverly Hancock, participant in our 1974 SST program and a junior majoring in textile chemistry, was the girls' counselor in 1977.

Her counterpart for the boys was Mr. Keith Jones, 1976 SSTP participant, who enrolled at Georgia Tech in June 1977 as a freshmen majoring in textile engineering. These fine, bright, scholarly and active young people contributed immeasurably to the 1977 program. Mr. Craig Anderson, Assistant to the Director of the School of Textile Engineering, lived in the same dormitory building as did the boys and close to the building in which the girls lived. Mr. Anderson's presence, close to the students, was of real help.

A larger fraction of students (80%) lived on campus in 1977 than in past years. A number of students who could have commuted lived on campus by choice. Their parents invested wisely the additional costs of board and room.

Students adjusted well to campus life. The program helped many to cope with being away from home and living on campus without the penalty of failure. A few of our participants probably would fail in college without this experience.

E. Problems

Perhaps our most difficult task is to help SSTP students to develop some feeling for the nature of science and engineering and for the diversity of opportunities they will enjoy in college and after. Most students know only structured, discipline-oriented, over-organized, and dogmatic secondary schools, which do not prepare them for college. Most SSTP participants have little feel for the experimental method and deductive reasoning, experimental technique, and little propensity to doubt, question, and test what they see, read, and hear. Therefore,

if participants are to have any meaningful experience in SSTP research problems, unjustfiably much faculty time is required for much one on one tutoring and help. We believe that we of the School of Textile Engineering and our colleagues in other Schools at Georgia Tech have made that commitment of time. The 1977 participants were at least as able, inquiring, and productive as the 1976 students and more so than those in our 1974 and 1975 SST program.

The commuters who are not outgoing and gregarious do not become part of the group to nearly the extent that those who live on campus do. We have tried to lure these people to our weekend outings. If we could call for them by automobile at their homes, several would participate more. About half of the commuters do participate in all planned recreational activities.

Again in 1977, we had no racial problems. SSTP participants developed good rapport and real affection for one another. Communication with blacks who seek only blacks as companions remains a problem for whites and members of other minority groups.

F. Changes in Future Programs

In future programs we shall try to continue to increase the diversity of research problems available. Further, we shall continue to encourage participants to suggest their own problems. Because of the diversity of ongoing research at Georgia Tech and the willingness of investigators to add research students to their groups or to branch out into new areas of investigation, we can find research advisors and facilities for most problems suggested by participants. Six (6) participants suggested their own projects and worked on them in our 1976 program.

We had more projects in "go" condition in 1977 than in any other year. More participants found equipment and materials easier to obtain in 1977 than in 1976 or previous years. We shall try to continue this improvement in 1978.

In 1978, we shall broaden our program a bit. At the junior-senior level in high school students should be exposed to the diversity and breadth of science and engineering so that they become aware of and perhaps interested in areas of science and engineering of which they may remain ignorant. Students can't study in fields of which they are unaware. The diversity of material in seminars will be increased some.

We have emphasized that students need not worry about deciding on major fields of study. The constant pressure from teachers, counselors, college admissions officers, and parents to elect majors bothers most students who really don't know that they want to study. Therefore, we have urged students to be undecided engineering or science majors and to take math, chemistry, and physics suitable for majors in each of these disciplines and the best English courses on campus. Further, we stress that as long as they take the "high road", choice of major is not as important as deans and registrars would have us believe. Taking the good courses suitable for majors in each discipline keeps options open. Further, we suggest that students group their elective courses and take what is in effect a second major. We try to orient our SSTP participants in this way and to wean them from their excessive cleaving to disciplines, curricula, etc.

We shall increase our efforts to make all commuters feel more a part of the group. Since young people will communicate with one another

better than with adults, we will ask our counselors and the participants to seek out the commuters and to include them in spontaneous on-campus activities in free time.

G. Effects of the Program

The effect on participants was to increase in each an appreciation science and engineering and an eagerness for real study at the university level. The SST program is excellent for recruiting good students to good schools. Seeing science and engineering first hand at Georgia Tech caused a few students with vague notions about studying some more esoteric subjects to consider science and engineering including polymer, fiber, and textile science and engineering.

Another effect of the program on some of the participants was to help some of the participants to "aim higher," at better colleges and universities in more difficult curricula. This broadening of interests and horizons and the realization that they can "make it" in the better schools means that that several of the forty-four (44) students, who participated in the whole program, probably will register in science or engineering curricula in strong schools instead of beginning in less demanding curricula in lesser schools.

At least six of the students are continuing to work on their research problems and will enter local and national competitions.

Students in our 1977 program developed the real friendship for one another that was obvious in the 1974, 1975, and 1976 groups. The 1977 group enjoyed being together, enough that they will come to Georgia Tech on January 12-15, 197, for a reunion. This regard for one another and communication among most students bridged differences in economic status, background, preparation, sex, and race. The participants learned

more from each other than from faculty and staff.

The principal effect of the 1973-1977 programs on the School of Textile Engineering is that we started or pushed forward some research programs which would have languished without this spur. Of the sixteen (16) problems worked on by students in 1977 in the School of Textile Engineering, fourteen (14) received principal impetus from SSTP students working on the problems; work on nine (9) of the sixteen (16) problems continues.

Another effect upon our school was to further acquaint us with and make us much more sensitive to hopes, needs, thinking, problems, strengths, and weaknesses of young people who are likely candidates for science and engineering. We learned how to reach several of these people through their schools, families, friends,etc. The School of Textile Engineering will continue to increase its contacts with potential students of science by visiting more schools, giving more seminars and demonstrations in schools, helping more teachers and students with research projects and demonstrations, entertaining more visiting students and teachers at Georgia Tech, etc.

As a direct result of our SST programs, the Atlanta City Schools held their annual Science Congress in the School of Textile Engineering on February 16-18, 1977 and will return on February 15-17, 1978. More than three hundred high school students will demonstrate their research and project work in science and mathematics.

H. Follow-up on the program

Follow-up on the program has begun. All participants in the 1977 program have received at least one letter from faculty and staff of the School of Textile Engineering. All have received a questionnaire

requesting participants' reactions to the program; thirty four (34) participants responded. All have received a group picture in color.

Georgia Tech faculty members are helping six of the participants to continue working on their research programs.

A demonstration kit showing polymerization of nylon, rubber, elasticity, drawing and texturing of fibers, fabric flammability, dyeing and finishing of fabrics will be distributed in January, 1978, to each of the high schools from which participants came. The student participants in SSTP will use these to demonstrate to fellow students some of what they have learned about polymers, fibers, and textiles.

The student participants, teachers who can come, and Georgia Tech staff and faculty will come to campus as guests of the faculty on January 12-15, 1978, for a reunion, recreation, and fellowship. At that time and in subsequent letters we shall learn the career plans of participants. We shall do our best to keep in touch with participants until they have graduated from colleges or become permanently employed after leaving school.

V. Suggested Improvements in the National Student Science Training Programs

This program is excellent; it reaches young people at the right time to save a few for science in spite of the thrust of secondary education away from science and other difficult disciplines. Further, our SST program makes some students aware of the diversity of opportunities for study in science and engineering and that many paths lead to similar goals. Students have to know the existence of different curricula and study programs before they come to college if they are to consider

enrolling in them.

The Foundation's staff knows better than we the three biggest improvements which can be made in the program. These are:

1) adequate funding for 200 plus individual programs,
2) announcing grants before September first of each year to give adequate time for publicizing programs and seeking additional funds for the following summer, and
3) enticing high school teachers to participate in the program.

Acknowledgements

Dr. Amad Tayebi, Assistant Professor of Textile Engineering, served as associate director of our 1977 SST program. His contributions in research, seminars, and administering the program were indispensible to the operation and success of the program. Professor Tayebi's special seminars on mechanics were high points in our 1977 SST program.

Mr. Craig Anderson, Assistant to the Director of the School of Textile Engineering, cared for most of the housekeeping, travel, and activities arrangements for the program. He also served as an extra, full time counselor for student participants. His contributions to the program made the program go; his easy, friendly empathy facilitated communication with participants.

Dr. W. Denney Freeston, Jr., Professor and Director of the School of Textile Engineering, worked in the SST program days, nights, and weekends as research adviser, seminar leader, counselor, chaperone, chauffeur, mechanic, and administrative supporter. His enthusiastic participation and encouragement insured success of our 1977 SST program.

Dr. Walter C. Carter, Professor of Textile Engineering and fine textile and polymer chemist, has contributed more to our 1973-1977 programs than any other member of our faculty in helping students with research problems. He is always willing to help students with research problems of wide diversity, from botany to chemistry.

The many members of the faculty, staff, and students of Georgia Tech listed on pages 15, 16, 20, 21, and 29 plus an equal number whose names don't appear and friends at Fernbank Science Center, American

Enka Company, Duke Power Company, and Callaway Gardens made our 1977 SST program a success.

Our friends in industry, who contributed $4,784, made possible field trips, recreation for participants, and the participation of at leas the extra four students in our 1977 program.

APPENDIX I - BROCHURE

Appendix II - Seminars & Demonstrations

1. "Our World of Giant Molecules" - J. L. Lundberg
2. "Force, Stress, Strain, etc. - W. D. Freeston
3. "Concepts of Equilibrium" - J. L. Lundberg
4. "Near Equilibrium Kinetics" - J. L. Lundberg
5. "Viscoelasticity of Polymers" - A. Tayebi
6. "Molecular Size" - J. L. Lundberg
7. "Periodicity & Chemical Bonding" - W. C. Carter
8. "Carbon to Carbon Bonding & Vinyl Polymerization" - W. C. Tincher
9. "Vinyl Polymerization & Copolymerization" - W. C. Tincher
10. "Chemical Bonding: Covalent & Ionic Bonds, Polarity, Acidity, etc." - W. C. Carter
11. "Chemical Bonding: SiO_2 & Other Oxides, Salts, Inorganic Compounds, Metals, etc." - W. C. Carter
12. "Chemical Bonding: Carbon to Oxygen - Chemistry of Ethers, Alcohols, Acids, Aldehydes, Ketones, etc." - W. C. Tincher
13. "Chemical Bonding: Carbon to Nitrogen - Chemistry of NH_3, Amines, Amides, Nitriles, etc." - W. C. Carter
14. "Polyamides: Nylons & Proteins" - W. C. Carter
15. "Polyethers: Cellulose and Starch. Polyesters: PET, DNA, RNA, etc." - F. L. Cook
16. "Kinetics & Differential Calculus" - J. L. Lundberg
17. "Rates of Chemical Reactions Including Chain Reactions" - F. L. Cook
18. "Molecular Weights, Average Molecular Weights & Molecular Weight Distributions" - W. C. Tincher
19. "Averages, Summations, Integration, Areas, Moments, etc." - W. C. Carter
20. "Polymers & States of Matter - Crystalline, Glassy, Rubbery Structures & Behavior" - J. L. Lundberg

21. "Flow Behavior of Polymers" - J. L. Lundberg

22. "Rubber Elasticity" - L. H. Olson

23. "Crystallization of Polymers" - J. L. Lundberg

24. "Structure and Morphology of Polymers" - J. L. Lundberg

25. "Fiber Drawing and Texturing" - D. R. Gentry

26. "Fiber Properties" - D. R. Gentry

27. "Scattering of Light by Fibers" - J. L. Lundberg

28. "Dyes" - W. C. Carter

29. "Dyes and Dyeing" - W. C. Carter

30. "Finishing of Textiles" - F. L. Cook

31. "Color: What is Color? How Do We Perceive Color?" - W. C. Tincher

32. "Fabric Flammability" - W. F. Thomas

33. "Yarn Formation: Old, and New" - A. Tayebi

34. "Fabric Formation" - A. Tayebi

35. "Knit Picking" - L. H. Olson

36. "Brainstorming - Useful Products from Fibers" - W. D. Freeston

37. "Carpets: Ancient Asia to Dalton, Georgia" - J. L. Lundberg

38. "Nonwovens and Novel Structures" - W. D. Freeston

39. "Computers, Automation and Control" - M. Konopasek

40. "Computers and Manufacturing" - M. Konopasek

41. "Environmental Problems" - W. C. Tincher

42. "Energy Problems" - J. L. Lundberg

43: "Future Expectations: Food, Fiber, Shelter, etc" - J. L. Lundberg

44. Research Reports by Participants

45. Research Reports by Participants

46. Research Reports by Participants

47. Research Reports by Participants

48. Research Reports by Participants

49. "Graduation: Presentation of certificates of participation and mementoes" - participants, parents, faculty, staff, and friends.

Extra Seminars

"Counselling at Tech, Effective Study Habits, Communicating, etc." - Barbara J. Winship and Thomas A. Parker

"How Well Do We Write?" - J. J. Bynum

"Lab Safety" - F. L. Cook

"The Craig Anderson Show: Fun with Textiles, Fibers, Polymers, etc." - C. Anderson

"College Admissions, TECH, etc." - C. Anderson

APPENDIX III - SCIENCE MOVIES

*1. THE BEACH - A RIVER OF SAND: Movement of sand along a shore.

*2. PRESSURE FIELDS AND FLUID ACCELERATION.

*3. CHANNEL FLOW OF A COMPRESSIBLE FLUID

*4. WHY MAN CREATES: Nature of the creative process. (Shown twice by request)

*5. CRYSTALS - AN INTRODUCTION: Structures & properties of crystals.

*6. PRINCIPLES OF OPTICAL MASERS - Old but good physics.

*7. RHEOLOGICAL BEHAVIOR OF FLUIDS: Non-Newtonian flow & normal stresses.

*8. EVIDENCE FOR THE ICE AGE: Landscapes and glaciers.

*9. PHYSICAL CHEMISTRY OF POLYMERS: Structures & properties of polymers.

*10. BRATTAIN ON SEMICONDUCTOR PHYSICS: Introduction to semiconductors.

*11. SIMILARITIES IN WAVE BEHAVIOR: Mechanical waves, properties.

*12. PROBING PLANETARY PROCESSES: Formation of the earth and moon.

*13. THE NEW SOLAR SYSTEM: What we have learned about the solar system from our space program.

*14. STUDYING THE BIG CATS OF AFRICA: New understanding of the big cats from careful study and photography.

*15. MORE WATER FOR A THIRSTY WORLD: Our over-accelerating demands for water, conservation, recycling, and new sources.

*16. SHARK - ANCIENT MYSTERY OF THE SEA

17. SAVING LIVES IN HIGH-RISE FIRES.

18. PROBING STORMS OVER AND UNDER THE SEA.

19. SCIENCE INVESTIGATES ENERGY FIELDS OF LIFE.

20. NEW HELP FOR HEARTS: Bioengineering helps to save lives.

21. AEROSPACE ENGINEERING - PAST, PRESENT, AND FUTURE.

22. SEEKING AND CONSERVING MINERAL RESOURCES.

23. ADVANCES IN BIOMEDICAL ENGINEERING.

* Shown in previous SST programs

Subjects included in these films are as follows:

Aerospace subjects	- 2 films
Biology	- 4
Biomedical Engineering	- 2
Chemistry	- 1
Engineering	- 8
Geology	- 4
Meteorology	- 1
Oceanography	- 2
Physics	- 6
Psychology	- 2
Rheology (and fluid flow)	- 3

APPENDIX IV - Group Activities - "Summer - 77" NSFSSTP

Date	Activity
Sunday, June 19	Open house & "Dutch treat" supper with parents and friends - Textile Engineering Building.
Saturday, June 25	Party - food, cokes & music at the School of Textile Engrg
Sunday, June 26	Visit Stone Mountain-hiking, swimming, canoeing, etc.
Saturday, July 2	Visit High Museum of Art and Underground Atlanta.
Sunday, July 3	Open house and supper at Lundberg's home.
Monday, July 4	Watch Peactree Road Race (10,000 meter run). Sports on campus - SSTP field day. Lenox Square for concert and fireworks or attend Atlanta Braves baseball game and fireworks show.
Sunday, July 10	Visit Cyclorama (Battle of Atlanta) and Grant Park Zoo. Attend Atlanta Symphony Concert in Piedmont Park.
Saturday, July 16	*Visit Callaway Gardens - swimming, fishing, and amusements
Sunday, July 17	Picnic and concert of Atlanta Symphony in Piedmont Park.
Saturday, July 23	Raft race down the Chattahoochee River. Coke and music party of the School of Textile Engineering.
Sunday, July 24	Craig Anderson's broiled steak dinner outside dormitories and concert of Atlanta Symphony in Piedmont Park.
Tuesday, July 26	*Swim at Clemson University beach and supper at Coneross Fish Lodge.
Saturday, July 30	Picnic outside school of Textile Engineering Building and coke and music party.
Sunday, July 31	Open house, supper, and birthday party for participants at Lundberg's home.
Tuesday, August 2	Visit Six Flags Over Georgia to study Newton's second law
Friday, August 5	"Graduation", open house, and reception - School of Textile Engineering

*Combined with educational field trips.

Appendix V - Students' Evaluation: Results

"Summer-77" NSF-SSTP Questionnaire

1. There were (too many 41%, too few 3%, right number 56%) seminars during the program.

2. Each seminar on the average was (too short 0%, too long 22%, right length 78%).

3. The ideal length for a seminar in the program would be (1 hour 21%, 1 1/2 hours 76%, 2 hours 3%, 2 1/2 hours 0%, 3 hours 0%).

4. Seminar material was (always 0%, often 57%, seldom 43%, never 0%) at a level difficult for me to understand.

5. The seminars which interested me the most had as their subject:

   a) Mathematics (N. Chafee and J. L. Lundberg) - 20 citations

   b) Mechanics (A. Tayebi) - 7 citations.

   c) Chemistry (W. C. Carter, F. L. Cook, J. L. Lundberg, W. C. Tincher) - 6

   d) Computers (M. Konopasek and Mary Trauner) - 5 citations

   e) "The Craig Anderson Show: Fun with Textiles, Fibers, Polymers, etc."- 5 citations.

   f) Nuclear Engineering (G. G. Eichholz) - 5 citations

6. The seminars which were least interesting had as their subjects:

   a) Textiles - 8 citations

   b) Polymers - 7 citations

   c) Fibers - 4 citations
      Dyeing - 4 citations
      Chemical bonding - 4 citations
      Thermodynamics - 4 citations

7. There were (too many 0%, too few 47%, right number of 53%) colloquia given by people outside the textile department's faculty.

8. The most interesting colloquia were "Mathematics - Useful Results and Pure Fun," Nathaniel Chafee School of Mathematics, Georgia Tech, and "Nuclear Engineering," Geoffrey G. Eichholz, School of Nuclear Engineering, Georgia Tech.

9. There was (too much 9%, too little 23%, the right amount of 68%) material covered during the 7 week period.

10. There were (too many 6%, too few 21%, the right number of 73%) research topics from which to choose.

11. Faculty assistance on my research topic was (excellent 70%, good 18%, fair 9%, poor 3%).

12. Materials and instruments needed to carry out my research were (easy 85%, difficult 15%) to obtain.

13. (More 13%, less 0%, the same amount of 62%) time should have been allotted for research.

14. (More 47%, Less 6%, the same amount of 47%) time should have been devoted to familiarizing me with Tech's research facilities.

    Specifically: Aerospace Engineering - 3 citations

    Other Schools - 2 citations
    Architecture, Chemistry, Engineering Experiment Station, Engineering Science and Mechanics, Mathematics Mechanical Engineering, Nuclear Engineering, Physics, laboratory facilities, available equipment, and faculty research - 1 citation each.

15. (More 35%, less 0%, the same amount of 65%) time should have been devoted to familiarizing me with Tech's instructional, resource, research and service facilities.

    Specifically: Aerospace Engineering, Ceramic Engineering, Chemical Engineering, Electrical Engineering, the library, Mathematics, solar research, "other schools and instructional facilities" - 1 citation each

16. (More 26%, less 0%, the same 74%) time should have been devoted to familiarizing me with Tech's recreational facilities.

    Specifically: Student Athletic Complex - 4 citations

    Music Room (Student Center), karate lessons, Student Center, swimming lessons, tennis lessions - 1 citation each

17. There were (too many 3%, too few 9%, the right number of 88%) organized outings.

18. The outings I enjoyed most were:

    a. Six Flags Over Georgia - 26 citations
    b. Callaway Gardens - 14 citations
    c. American Enka Co., Duke Power, Clemson Beach - 12 citations

19. The outings I enjoyed the least were:

    a. Underground Atlanta - 6 citations
    b. High Museum of Art - 4 citations
    c. American Enka, Duke Power, Clemson Beach, and Fernbank Science Center - 3 citations each

20. I would like to have had (more 38%, less 0%, the same amount of 62%) free time on weeknights and weekends.

21. Had I had more free time, I would have used it to: Athletics - 8 citations; research, reading,and visiting Atlanta - 6 citations each; sleeping and "recreation" - 4 citations each.

22. I would recommend this program to my fellow students if:

    a. it were run much the same way 50%
    b. a few changes were made 39%
    c. the following changes were made 11%: Decrease amount of textiles subject matter - 4 citations. Place more time and emphasis on research, and permit more free time and later curfew hours - 2 citations each.

23. Please tell us what you think and how you feel about our summer programs. Your comments will help us in plans for "SUMMER-78"

    Too many afternoon seminars - 5 citations

    More mathematics - 2 citations

    More college preparatory seminars; start seminars at 10 a.m.; lower level for seminars; fewer tours in first week; more topics in seminars, and projects should be ready to go before students arrive - 1 citation each

    "Rave"compliments - 16 citations

    Excellent program - 12 citations

    Good program - 4 citations

    No comment - 2